APPLICATION FOR UNITED STATES LETTERS PATENT

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for

PROGRAMMABLE OPTICAL MOUSE

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PROGRAMMABLE OPTICAL MOUSE

BACKGROUND

[1] In operation, a typical optical computer mouse captures a series of images of a surface on which the mouse is located, compares one image to the next image to calculate a vector value that represents the movement of the mouse, and transmits this vector to a computer, which moves a displayed cursor a corresponding distance, at a corresponding speed, and in a corresponding direction.

[2] A wireless optical mouse typically transmits this vector to the computer via a uni-directional wireless channel. That is, over this channel, the mouse can transmit information to the computer, but the computer cannot transmit information to the mouse.

[3] Unfortunately, because the computer typically cannot transmit information to the mouse, it is often impossible to modify the mouse's factory settings, which determine its operating characteristics. One solution that would allow the optical mouse to receive communications from the computer is to employ a wireless bi-directional channel between the computer and mouse. However, although one can implement such a bi-directional channel, it would significantly increase the complexity, cost, and power consumption of the mouse.

SUMMARY

[4] According to an embodiment of the invention, an optical-signal receiver comprises an optical sensor operable to receive an optical signal from an optical-signal emitter communicatively coupled to an electronic system and a processor operable to implement a performance characteristic value specified by the optical signal.

BRIEF DESCRIPTION OF THE DRAWINGS

[5] **FIG. 1** is a side cutaway view of a wireless optical mouse according to an embodiment of the invention;

[6] **FIG. 2** is a partial schematic diagram of the circuitry within the wireless optical mouse of **FIG. 1** according to an embodiment of the invention;

[7] **FIG. 3** is a perspective view of the mouse of **FIG. 1** receiving optical programming signals from a display device in accordance with an embodiment of the invention; and

[8] **FIG. 4** is a schematic diagram of an alternative system for programming the mouse of **FIG. 1** according to an embodiment of the invention.

DETAILED DESCRIPTION

[9] **FIGS. 1** and **2** illustrate an optical-signal receiver, such as a wireless optical mouse ***10***, according to an embodiment of the invention. The optical mouse ***10*** includes a casing ***20*** in which is disposed a light-emitting unit ***30*** such as a light-emitting diode, a lens ***40***, an integrated circuit (IC) ***50*** having an optical sensor ***60*** such as a CMOS imaging array and on-board processor ***70*** (not shown in **FIG. 1**), and a printed circuit board (PCB) ***80*** upon which is disposed the unit 30, IC 50, and a transmitter ***90***. Conductive traces (not shown) on the PCB **80** enable communication between the transmitter ***90*** and the IC ***50***. A clickable button ***110***, which allows an operator to, for example, select items displayed on a display device ***112***, is mounted in an opening in an upper surface of the casing 20.

[10] In operation according to an embodiment of the invention, the light-emitting unit ***30*** emits light into a chamber ***120*** disposed within the casing ***20***. The lens ***40*** is disposed within the chamber ***120*** and focuses the light reflected from a reference surface, such as a mouse pad ***130***, on to the optical sensor ***60***. The optical sensor ***60*** senses the reflected light, and in a manner known in the art, calculates a vector value that represents the movement of the mouse ***10*** relative to the pad ***130***. The transmitter ***90*** transmits the vector value to a computer system ***134*** coupled to the display device ***112*** as part of a wireless signal 132, which may be a radio-frequency or optical signal. In response to the received vector value, the computer ***134*** moves a cursor (not shown) on the display ***112*** a corresponding distance, at a corresponding speed, and in a corresponding direction.

[11] **Fig. 2** is a partial schematic diagram of the circuitry within the mouse ***10*** according to an embodiment of the invention. The IC ***50***, in addition to comprising the processor ***70*** and optical sensor ***60***, further comprises a non-volatile memory ***140***. In alternative embodiments of the invention, the processor 70, sensor 60 and/or memory may each be arranged on separate integrated circuits. The memory ***140*** stores settings associated with characteristics, such as the rate at which the sensor ***60*** captures images of the reference surface ***130***, inactivity-period threshold (*i.e.,* the period of inactivity after which the mouse ***10*** enters a low-power, *i.e.*, "sleep" mode) and other functional properties that govern the performance of the mouse.

[12] Referring to FIGS. 1-3, the programming of the characteristic settings stored in the memory 140 is discussed according to an embodiment of the invention. The settings may be wirelessly altered by optical signals generated by an optical signal generator such as the computer system 134, displayed by an optical-signal emitter such as the display device 112, and received by the optical sensor 60.. For example, the optical signals may represent settings data ***160*** in the form of a stream of pixels of varying shades of darkness displayed by the display device ***112***. For example, a dark pixel ***170*** may represent a logic 1, and a light pixel ***180*** may represent a logic Ø, or vice versa. Alternatively, the display ***112*** may "flash" the settings data to the mouse ***10*** as a train of light pulses that form coded data. For example, two successful flashes within a predetermined time window might represent a logic 1, and one flash with in the window may represent a logic Ø. Of course, other coding schemes may be used.

[13] Still referring to **FIGS. 1-3**, an operator programs or reprograms the settings of the mouse ***10*** by holding the mouse in a predetermined position with reference to the display ***112*** so as to allow the optical sensor ***60*** to receive the data ***160***. As a precondition to receiving the data ***160***, an operator may cause the mouse ***10*** to enter a programming mode by, for example, depressing the button ***110*** for a predetermined length of time or predetermined number of times. In an alternative embodiment, the mouse ***10*** includes a secondary optical sensor (not shown) such as a photo diode that receives the data ***160***. Consequently, by generating the data ***160***, the computer system ***134*** may, via the display ***112***, program the setting of the mouse

10. The processor ***70*** is configured to demodulate/decode the data ***160*** received by the sensor **60** (or other dedicated sensor) and modify the performance settings stored in the memory ***140*** accordingly.

[14] To select the desired settings, an operator may employ the mouse ***10*** to specify, via one or more dialog boxes ***190*** generated by the computer system ***134*** and displayed on the display device ***112***, a setting value according to which the user desires the mouse to operate. Subsequently, the computer system ***134*** generates on the display device ***112*** the data ***160*** that, once received and processed by the mouse ***10***, causes the mouse to operate according to the selected setting value. In an embodiment, the mouse ***10*** can provide a signal to the computer system ***134*** confirming that the mouse is operating according to the selected value. The computer system ***134*** may cause a message to be displayed by the display ***112*** that acknowledges this confirmation or indicates a programming error.

[15] **FIG. 4** is a diagram of a system that incorporates the mouse ***10*** of **FIG.1** according to an embodiment of the invention. The transmitter ***90*** (**FIG. 2**) communicates the motion vector (*i.e.*, the velocity with respect to the surface ***130***) of the mouse ***10*** to a base station ***210*** over a wireless channel ***220***. The base station ***210***, in turn, communicates the motion vector to the computer system ***134***. In alternative implementations, the base station ***210*** may be communicatively coupled to the computer system ***134*** via a wireless channel ***230*** or cable connection ***240***.

[16] As discussed above, the mouse ***10*** is operable to receive from the display device ***112*** optical programming signals generated by the computer system ***134***. In an alternative embodiment, the base station **210** may comprise an emitter ***250*** such as a LED operable to emit optical programming signals generated by the computer system ***134*** that are similar to the data set ***160*** discussed above in conjunction with **FIG. 3**. The mouse ***10*** may mate with the station ***210*** so that the optical sensor ***60*** (**FIG. 1**) may receive the optical programming signals from the emitter ***250***.

[17] Alternative embodiments are contemplated. For example, the mouse ***10*** may be programmed by optical signals from a light-emitting device (not shown) that is stand alone, *i.e.*, is not communicatively coupled to the computer system ***134***

or, the mouse ***10*** may be manually programmable with an operator-controlled light source such as a laser pointer or flashlight.

[18] The preceding discussion is presented to enable a person skilled in the art to make and use the invention. Various modifications to the disclosed embodiments will be readily apparent to those skilled in the art, and the generic principles herein may be applied to other embodiments and applications without departing from the spirit and scope of the present invention. Thus, the present invention is not intended to be limited to the embodiments shown, but is to be accorded the widest scope consistent with the principles and features disclosed herein.